

Fig 1  
Top Level Overview  
of General Process

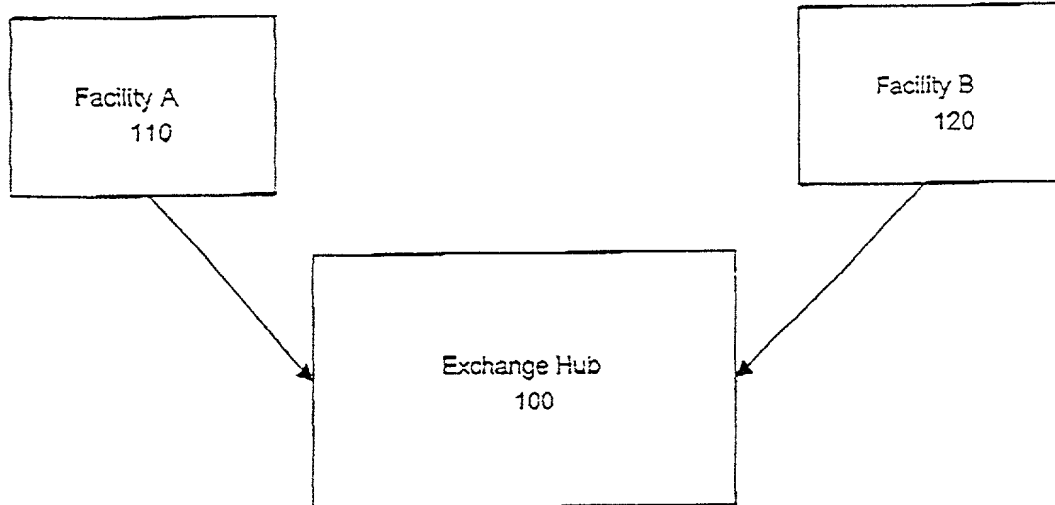


Fig. 2  
EBC Example

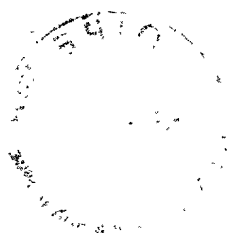
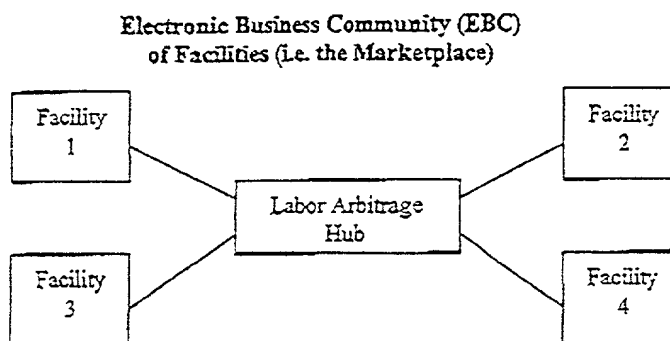


Figure 3: Labor Arbitrage Electronic Business Community. *An Intelligent Marketplace.*



NOTE: Multiple, separate, or overlapping EBC's exist at [intellicost.com](http://intellicost.com). For example, in healthcare, EBC must be in same geographic region.

Figure 4: Labor Arbitrage Electronic Business Community.

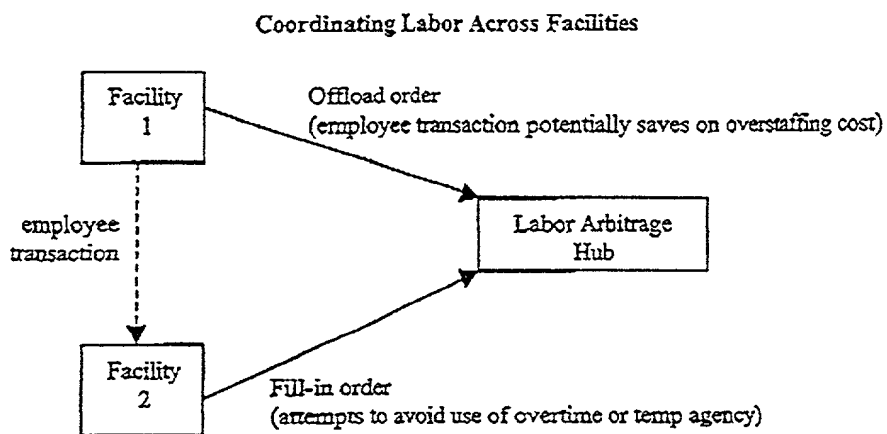
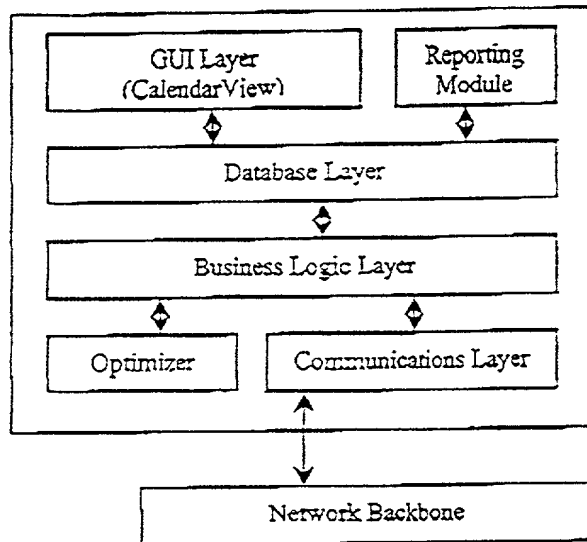


Figure 5: Client Process Layers



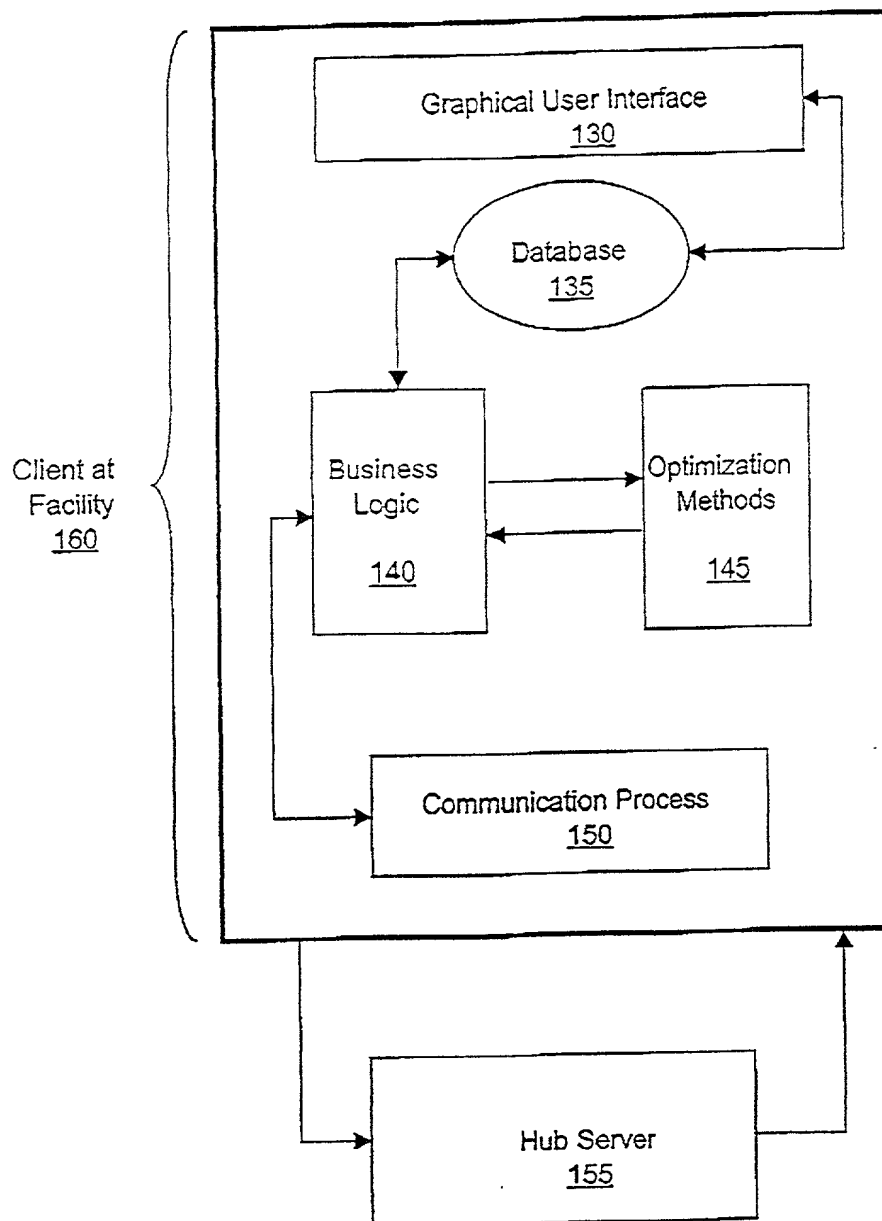


Fig. 6  
Client Process at Facility

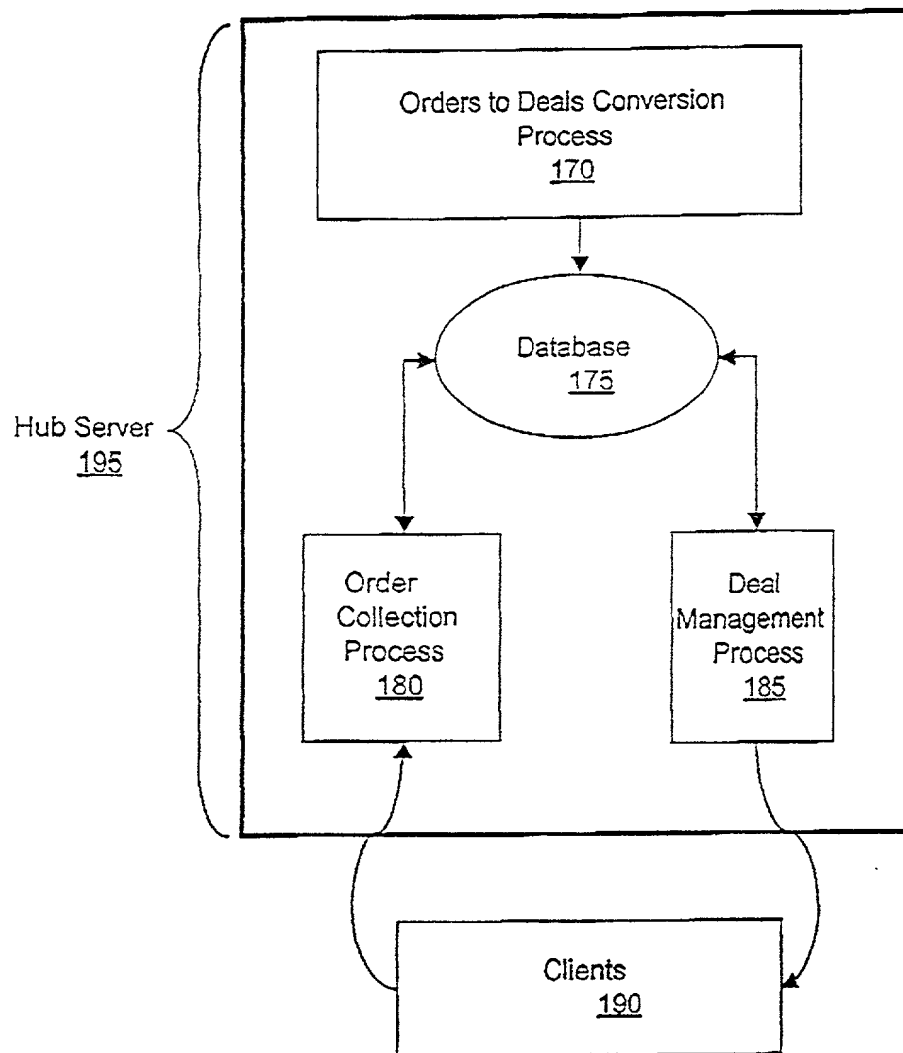
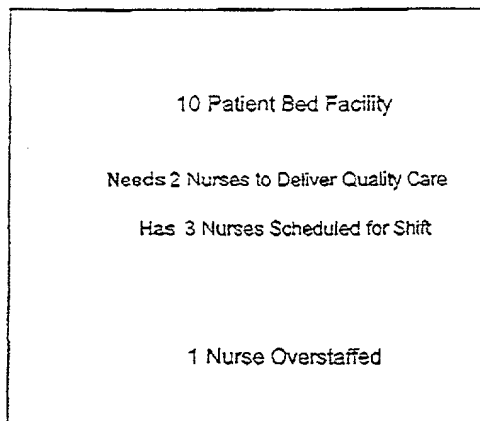
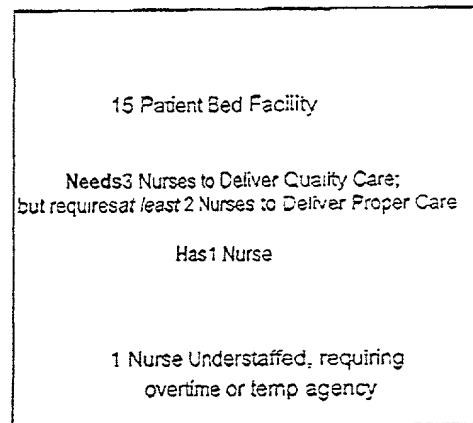


Fig. 7  
Server Process at  
Hub

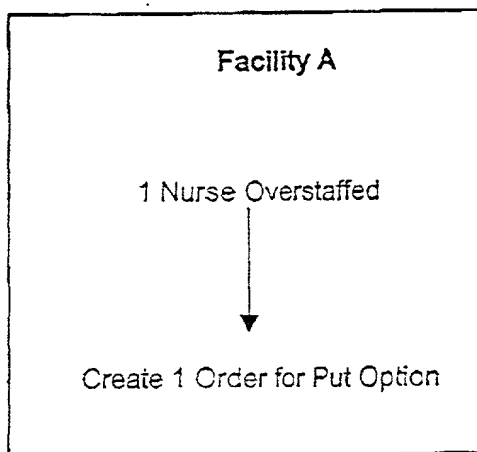


Facility A  
200

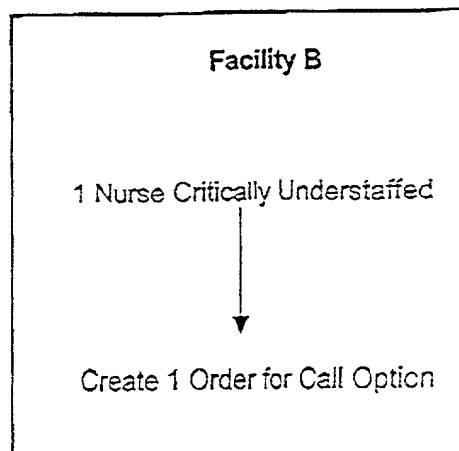


Facility B  
210

Fig. 8  
Staffing Situation at  
Example Facilities



300



310

<u>Employee Suitability</u>			
<u>Employee</u>		<u>Flexibility Index</u>	<u>Qualification Index</u>
A1		45	100
A2		70	100
A3		30	100

340

330

320

Fig. 9  
Determining Need for,  
and Creating, Option  
Orders



Figure 10: Options Order Valuation

**Facility A**

1 overstaffed shift excess cost  
simple illustration

8 hours \* \$20/hour = \$160  
Put option value = \$160

**Facility B**

1 understaffed to critical shift excess  
cost, simple illustration

(8 hours \* \$20/hr = \$160 for regular,  
in house employee)

However, 8 hours \* \$40/hr = \$320  
for typical agency employee

Figure 11: Internal Transaction Valuation and Selection

(employing change management to minimize disruption, which is critical to exchange valuation)

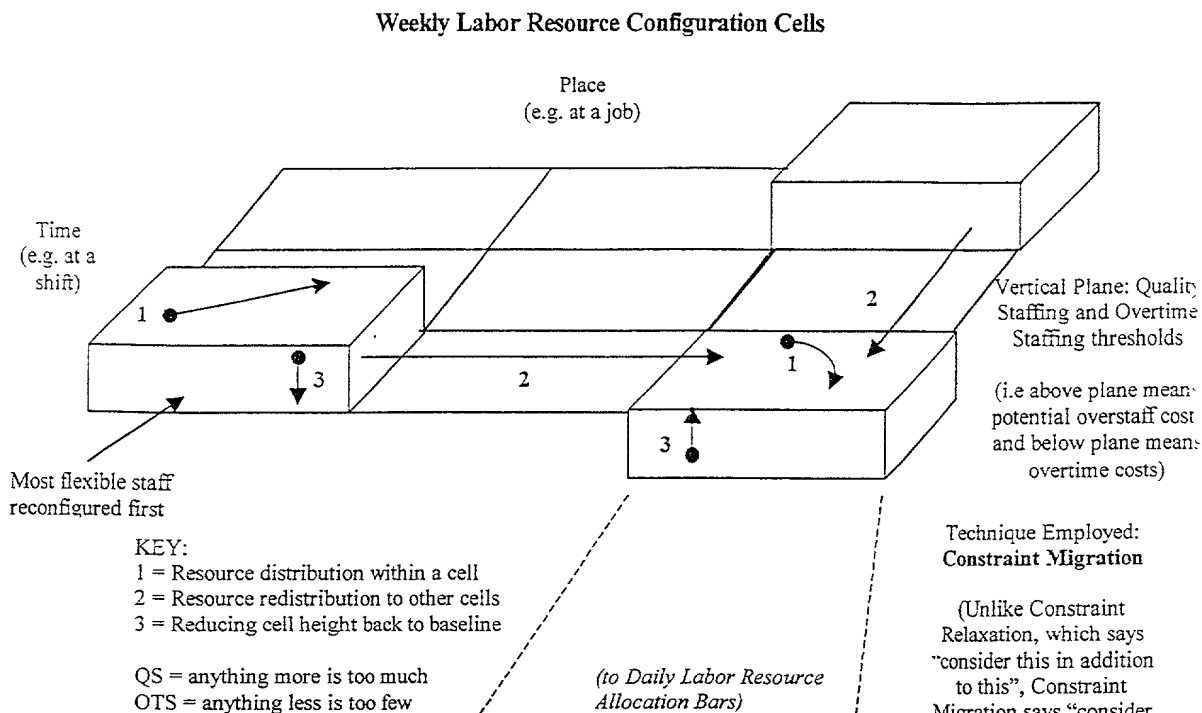
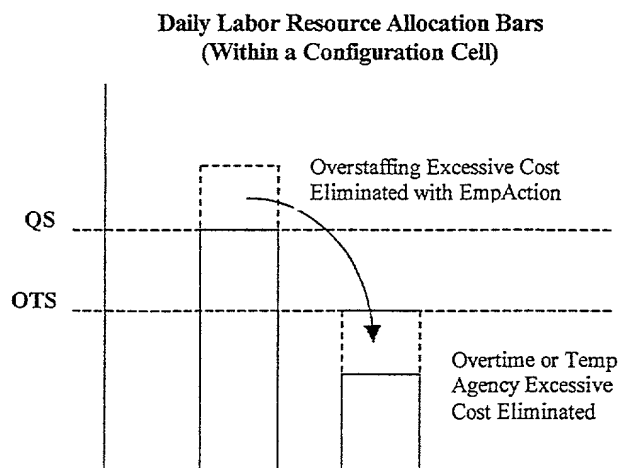


Figure 12 : Intellicost Transaction Valuation and Selection.



**NOTES:**

- Determine the highest return (savings and least risk (i.e. employee backlash EmpAction using expected values of return/risk table
- Higher return/risk levels can be achieved depending on model chosen
- Risk based on factors such as employee cooperativeness and replaceability

Figure 13: Determining Desired Strike Price Range of Option Order

**Facility A**

**Facility B**

Policy:

**Call:**

Purchasing range for nurse staff for call  
option order  
\$100 - \$200

**Call:**

\$120 - \$175

**Put:**

Subsidy range for option order  
\$0 - \$50

**Put:**

\$10 - \$60

or

or

Use a % of normal cost range

Use a % of normal cost range

**Call:** 62% - 120%

75% - 109%

**Put:** 0% - 30%

6% - 37.5%

or

or

Facility A wants to pay only \$0 - \$50 for  
this shift, so facility wants recipient to pay  
for this shift

Facility B wants to pay \$120-  
\$175 for this shift so a  
subsidy (of normal price) of

\$110 - \$160

\$15 - \$40

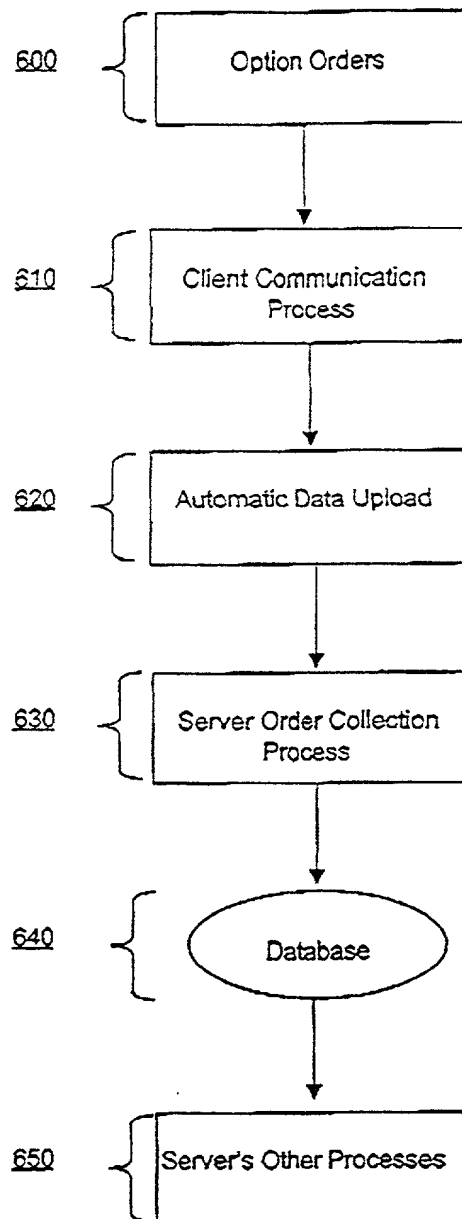


Fig. 14  
Delivering Option  
Order to  
Exchange Hub

700

From Facility	To Facility		
	A	B	C
A	0	\$320	\$220
B	0	0	0
C	0	\$40	0

710

720

730

740

Fig. 15  
Option Orders  
Matching for Potential  
Deals

From Facility	To Facility		
	A	B	C
A	0	\$320	\$220
B	0	0	0
C	0	\$40	0

Facility A: 95 % chance of overstaffing \* \$160 for OS=\$152  
\$152- 50 subsidy = \$102 ROI vs \$160

Facility B: 75% chance of agency usage \* \$160 for OT= \$12  
\$120-\$15 subsidy = \$105 ROI vs \$160

Facility A Expected Value Ranges:

Lower Bound Expected Value:

[Probability of savings \* savings from costs avoided or added earnings] - highest deal subsidy cost

Upper Bound Expected Value:

[100% \* Highest savings] - lowest subsidy] i.e. return minus investment

repeat for facility B

whichever facility's combined expected value is higher becomes bidder,  
regardless of whether they will be the donor or recipient of employee transfer,  
while lower becomes asker.

Fig. 16  
Bidder vs. Asker Determination  
in Option Deal Negotiation

### Strike Price

(Note: Strike Price is for Asset Price + Fees, & is Payment to Intellicost for Transfer of Underlying Asset)  
Strike Price is what each side pays us for deal to happen...

	Fac A	Fac B	Scenario 1: NO DEAL	
LB ROI	145	45	Asker	Bidder
UB ROI	160	155	ROI Range	LB ROI UB ROI
Tot. ROI	305	200	155 45	145 160
Donor	Y		UB ROI LB ROI	
Min. Subsidy	0		Strike Price of Asset 10 120	15 0
Max. Subsidy	15		Transfer Min.Prm. Max.Prm.	Max.Prm. Min.Prm.
Recipient		Y		
Min. Premium		-150		
Max. Premium		-40		
Bidder	Y			
Asker		Y		
Asset Price	160	160		
Expect. Return	180	5		
	-25	-100		
Closest Gap: In Strike Price			Proposed Deal Price: 125	Deal Valuation: 45
				(ie: Deal Price - Asset Price)

Fac A will give assg for \$15, but Fac B needs \$40 payment to make shift = \$120 cost  
Therefore... NO DEAL (since not all parties can make money on the deal)

### Next Scenario...

	Fac A	Fac B	Scenario 2: DEAL	
LB ROI	145	5	Asker	Bidder
UB ROI	160	15	ROI Range	LB ROI UB ROI
Tot. ROI	305	20	15 5	145 160
Donor	Y		UB ROI LB ROI	
Min. Subsidy	0		Strike Price of Asset 160 170	15 0
Max. Subsidy	15		Transfer Min.Prm. Max.Prm.	Max.Prm. Min.Prm.
Recipient		Y		
Min. Premium		0		
Max. Premium		10		
Bidder	Y			
Asker		Y		
Asset Price	160	160		
Expect. Return	160	15		
	25	-140		
Closest Gap: In Strike Price			Proposed Deal Price: 185	Deal Valuation: 25
				(ie: Deal Price - Asset Price)

So to get Fac B the best possible deal within the bidder's acceptance range,

we simply have Fac A pay its highest subsidy...

Therefore...

Strike Price for Fac A =

Pay Intellicost \$15, which is its max subsidy

Strike Price for Fac B =

Pay Intellicost \$160, which is its min premium plus the asset price

### Comments:

Here the strike price is determined by taking the asker's lowest subsidy offering as the strike price,  
- IF it still falls into a range acceptable for the bidder.

So given that we now want the eventual deal to benefit the asker (Fac B) as much as possible,  
we will let Fac A subsidize the deal a little more in this case.

Note that Facility A is becoming the bidder ironically, even though Fac B is the one needing staff, since it would then have the greater incentive to strike the deal due to the higher possible return. Consequently, the negotiation would thus take a different path as we would try and see Fac A get the better of strike price.

Note that strike prices will be different depending on whether Intellicost will be taking spreads or not

### Strike Price

If taking spread

Fac B will pay us \$10 dollars to get the employee, (as well as \$160 to employee)

while Fac A will pay us \$15 to offload employee

For a total spread of...

\$25 Netted by Intellicost

which means payments from each facility of:

Fac A =

\$15 Paid to Intellicost

Fac B =

\$170 Paid to Intellicost

and employee

### Strike Price

If NOT taking spread

Fig. 17  
Determining Final Strike Price  
for Option Deal

1000

From Facility	To Facility		
	A	B	C
A	0	\$320	\$220
B	0	0	0
C	0	\$40	0

1010

1020

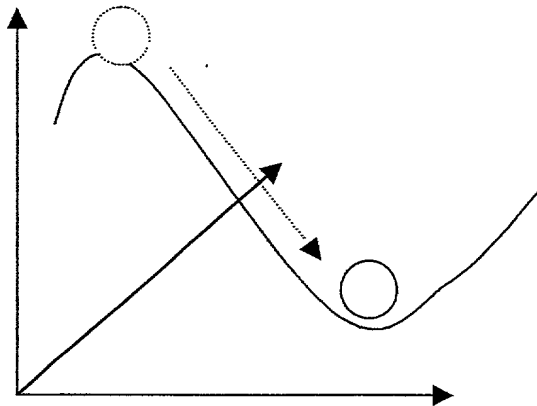
1030

**Fig. 18**  
Determining and Prioritizing which Option  
Deals to Accept to Members of the EBC,  
and When to Do So



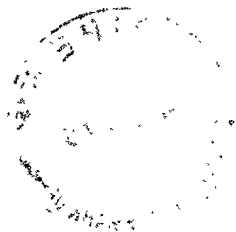
Figure 19: Optimization via Gradient Descent  
(here showing how the technique canvasses a cost terrain)

This optimization technique (also known as "hill climbing") can be used to find an optimal or oftentimes, at least, a near-optimal solution for a variety of transactions, whether it be assignments, employee-actions, or deals.



**3-D Cost Terrain Problem-Solving  
Using Gradient Descent**  
(here finding a local minimum)

20220518-022002



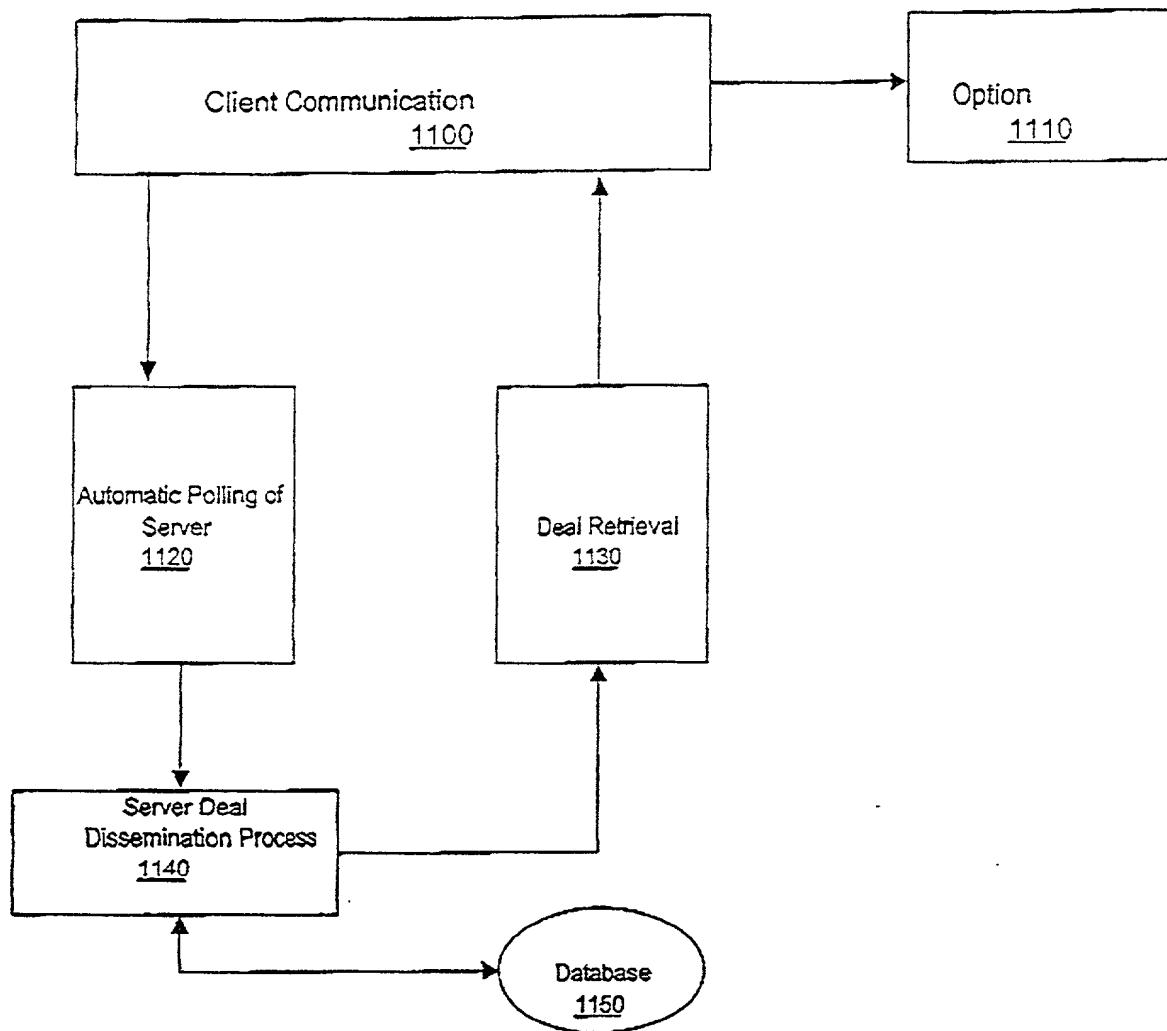


Fig. 20  
Delivering Option Tentative Contract  
from Exchange Hub Back to Clients at  
Facility

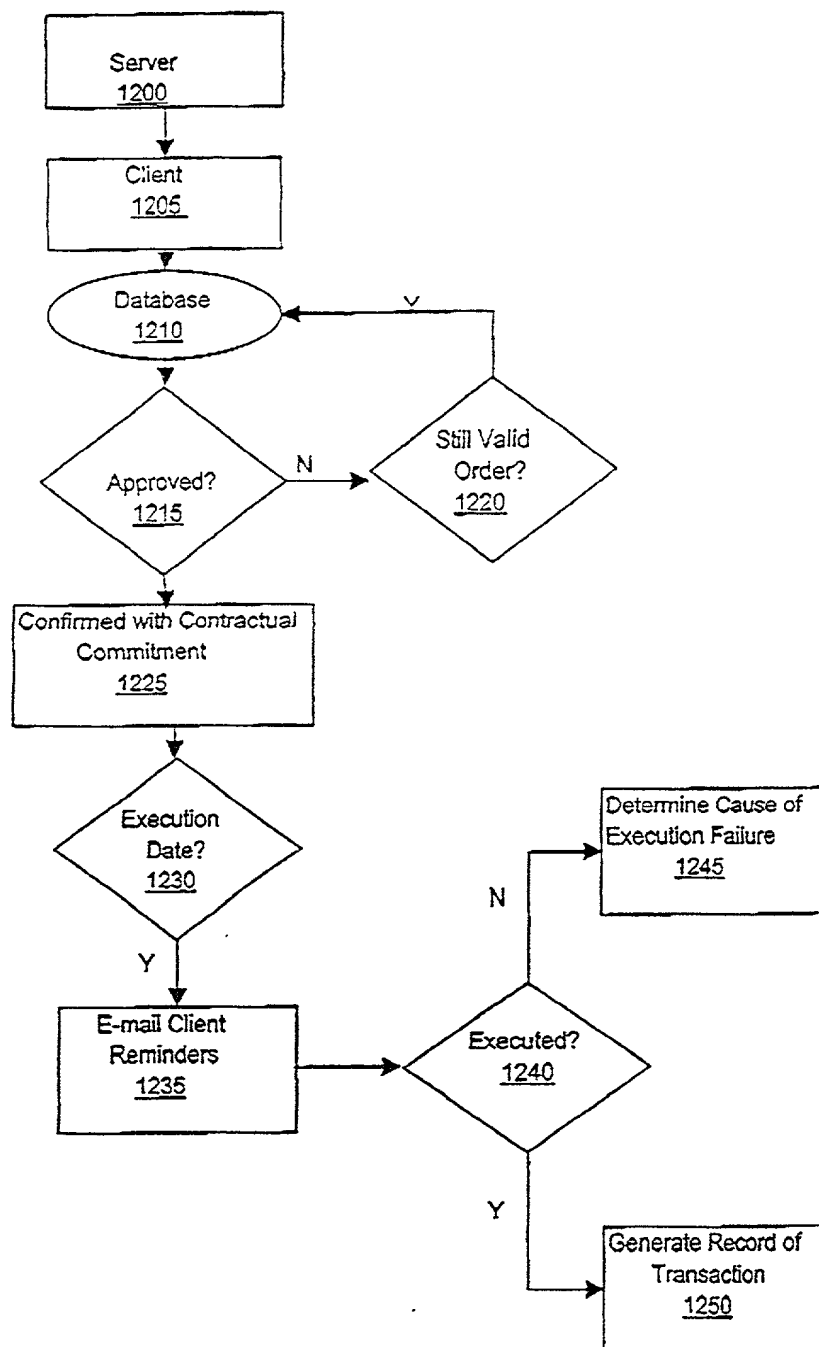


Fig. 21  
Tentative Option  
Contract Execution

Figure 22

Labor Arbitrage Process as the Facility Sees It

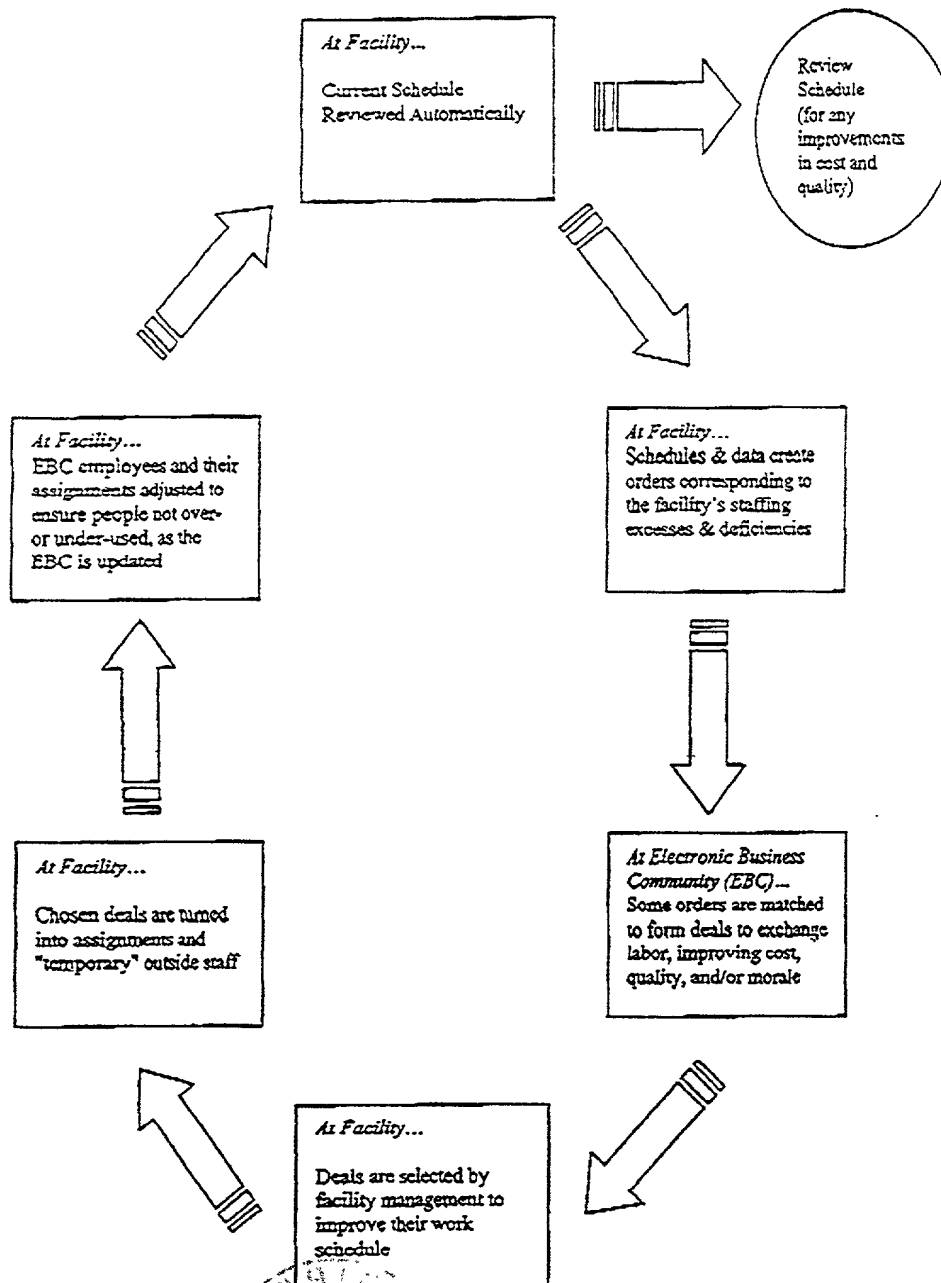


Figure 23  
Process Categories Overview

How Client-User interactions fit into process categories already covered, namely Client-Server and Server Arbitrage areas.

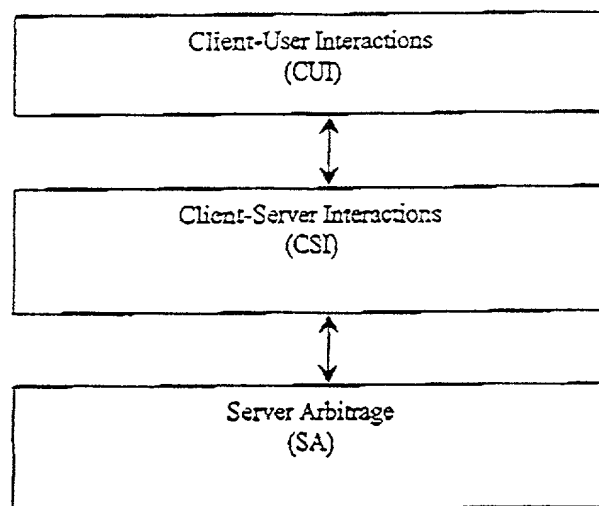
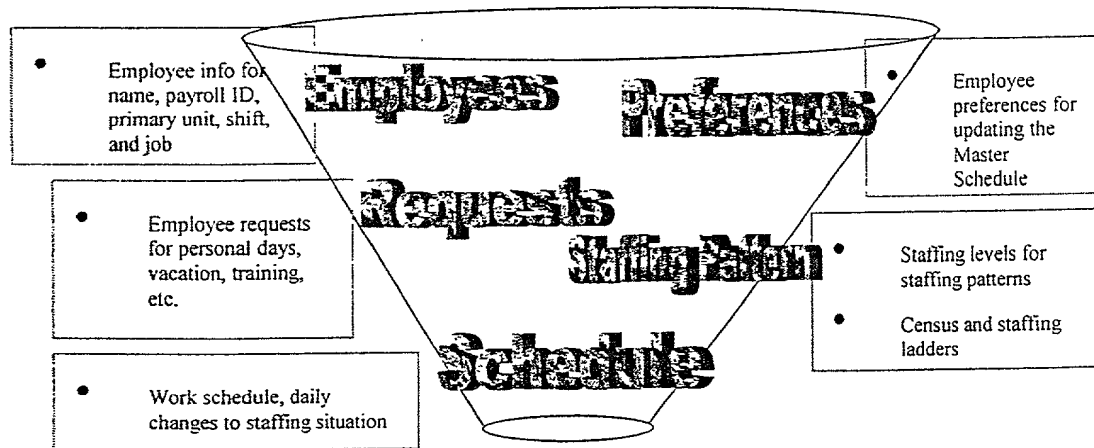


Figure 24

Interfaces used in Client-User Interactions (CUI) Component

"Data Funnel" Overview of General Types of Data required to enable EBC Arbitrage.



- **Employees (ES)** – this represents the data collected by the Employee Information Editor screen.
- **Preferences (PS)** – this represents the data collected by the Rotating Schedule and Preferences Editor screen.
- **Requests (RS)** – this represents the data collected by the Requests Editor screen.
- **Staffing Pattern (SS)** – this represents the data collected by the Staffing Levels Editor screen.
- **Schedule (SC)** – this represents the data collected and edited by the CalendarView screen and Assignment Editor screen.

Figure 25

Sample screen to enter and maintain employee information.

Objective of the Screen:

- To capture the data relating to the labor supply elements, which are the employees that can be utilized to staff a particular staffing need.

Descriptions of Essential Fields Used by Arbitrage Process: (Screen Code CULES.)

- Last Name and First Name – to indicate easily to the facility which employee is involved.
- ID-Number – this is a “globally unique” identifier for the employee throughout the entire potential scope of the EBC. Usually involves appending an employee’s local payroll number to the globally unique facility ID. However, it could simply be the employee’s Social Security Number.
- Primary Job – this is the primary job that the employee is qualified to work, such as Registered Nurse, Nursing Assistant, etc.
- Primary Shift – this is preferred shift that the employee expects to work.
- Primary Unit – this is the floor, wing, or other unit where the employee is asked to focus their time in order to offer the patients more “continuity of care” (i.e. customized attention).
- Flexibility – this is the simple default flexibility of the employee as initially assessed by the Staffing Coordinator. More complex formulas derive flexibility at later stages.
- Minimum Shifts Per Week – this is the minimum shifts expected by the employee (usually 5 per week is expected by a Full-Time Employee, or FTE).
- Minimum Hours Per Week – minimum hours expected by the employee.
- Maximum Shifts Per Week – maximum expected or allowed for the employee.
- Maximum Hours Per Week – maximum expected or allowed for the employee.
- Active Date – this is the first date that an employee can be utilized in staffing.
- Inactive Date – this is the last day that an employee can be utilized in staffing.

Figure 26

Sample screen to enter and maintain the "Master Schedule" and Availability of each Employee.

**Objective of the Screen:**

- To capture the data relating to the employees' normal permanent availability or mandatory scheduling constraints that should be used when evaluating their "fit" for a particular assignment.

**Descriptions of Essential Fields Used by Arbitrage Process: (Screen Code CULPS.)**

1. Start Date of Preferences' Week - this tells the system to which time-frame these preferences apply to this employee.
2. Name - this is the name of the employee to which the preferences apply.
3. Must Schedule - this indicates that this preference is a mandatory assignment, whether the employee is needed or not.
4. Can Schedule - this indicates that the employee has stated that they are available to work, and thus represents a possible assignment if the employee is needed.
5. Don't Schedule - this is to indicate that the employee has said they cannot work this day, time, shift, etc.
6. Shift - this is to indicate the time-period for the day the employee can work. There are 3 standard shifts usually seen in healthcare: Day (normally 7am-3pm), Evening (normally 3pm-11pm), and Night (normally 11pm-7am).
7. Start-Time - this is used if the time for this preference is not a standard Day/Evening/Night time period mentioned above.
8. End-Time - same as above.
9. Unit - this is if the employee is expected to or expecting to work a different unit from the one they should normally be scheduled at.
10. Job - this is for noting the job qualification of the employee for this particular preference, if different from their primary job type they are expected to work.



Figure 27

Sample screen to enter and maintain employee requests for time-off.

Objective of the Screen:

- To capture the data relating to the employees' temporary availability constraints.

Descriptions of Essential Fields Used by Arbitrage Process: (Screen Code CULRS.)

1. Date – the date of the request for time off.
2. Name – the employee's name that is requesting off.
3. Reason – the reason that the employee has given for their needing to schedule a day off.

202201-58102001

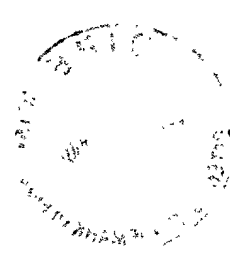


Figure 28

Sample screen to enter and maintain staffing levels needed per job, unit, and shift, including the desired quality level as well as absolute minimum level.

**Objective of the Screen:**

- To capture the data relating to the labor demand elements, which are the slots required to staff a particular staffing need.

**Descriptions of Essential Fields Used by Arbitrage Process: (Screen Code CULSS.)**

1. Date of Level – this is the date of when a particular need is in effect.
2. Defined Level Name – this defined name is essentially the time-place attributes of the staffing need, such as job-unit-shift-for-this-day.
3. Job – this is the job qualification required for this particular staffing need.
4. Unit – this is the unit to which this particular staffing need applies.
5. Shift – this is the time-period of the day to which this particular staffing need applies.
6. Overtime Level – this is the staffing level that the facility feels is necessary to deliver the absolute minimum level of service and care to their patients/residents. Anything less than this level is considered requiring of staffing by any means possible, including Agency or overtime, and is thus likely going to involve excess cost (i.e. cost is more than the standard shift of an in-house employee).
7. Quality Level Level – this is the staffing level that the facility feels is necessary to deliver quality service and care to their patients/residents. Anything more than this level is considered to be an excess cost from overstaffing.

**NOTE:**

There is also a standard Facility Data Screen to capture the following types of information, among others:

1. Facility Name, address, & zip code
2. The facility's job types, shift time periods, and unit names
3. The various wage rates for the different jobs, including a entry level wage or average wage rate
4. The various budget data, some through configuration files

Figure 29

Sample screens showing various descriptions of a Work Schedule.

The screenshot displays a work schedule application window. At the top, there is a menu bar with options: File, Edit, View, Enter, Perform, Report, Communicate, Help. Below the menu bar is a toolbar with icons for 'Frequent Changes' and 'Infrequent Changes'. A filter box shows 'Employee: Patricia Adams' and 'Sort by:'. The main area is a calendar for February 2000. The calendar grid shows days of the week and dates, with assignments listed for each day. For example, on February 6, assignments include 11:00p Alexander, 3:00p Akhtar, C, 11:00p Amuchie, 11:00p Alexander, 3:00p Barber, P, 11:00p Anthony, A, 11:00p Barber, P, 11:00p Bane, P, 3:00p Barber, P, 11:00p Bane, P. A 'Working multiple units' section is visible at the bottom, showing a table of assignments for different units and dates. The table has columns for 'Unit', 'Date', 'Job', 'Shift', and 'Assignment'. The table shows assignments for various units like '1N', '2N', '3N', '4N', '5N', '6N', '7N', '8N', '9N', '10N', '11N', '12N', '13N', '14N', '15N', '16N', '17N', '18N', '19N', '20N', '21N', '22N', '23N', '24N', '25N', '26N', '27N', '28N', '29N', '30N', '31N'. The table also shows assignments for different jobs like '1N', '2N', '3N', '4N', '5N', '6N', '7N', '8N', '9N', '10N', '11N', '12N', '13N', '14N', '15N', '16N', '17N', '18N', '19N', '20N', '21N', '22N', '23N', '24N', '25N', '26N', '27N', '28N', '29N', '30N', '31N'. The table also shows assignments for different shifts like '1N', '2N', '3N', '4N', '5N', '6N', '7N', '8N', '9N', '10N', '11N', '12N', '13N', '14N', '15N', '16N', '17N', '18N', '19N', '20N', '21N', '22N', '23N', '24N', '25N', '26N', '27N', '28N', '29N', '30N', '31N'. The table also shows assignments for different units like '1N', '2N', '3N', '4N', '5N', '6N', '7N', '8N', '9N', '10N', '11N', '12N', '13N', '14N', '15N', '16N', '17N', '18N', '19N', '20N', '21N', '22N', '23N', '24N', '25N', '26N', '27N', '28N', '29N', '30N', '31N'.

#### Objectives of the Screen:

- To display the current work schedule that is used to determine the current staffing situation, as well as capture the data relating to the changes in that situation.

#### Descriptions of Key Components Used by Arbitrage Process: (Screen Code CUI.SC.)

- Day Cell – shows the day of the work schedule, and holds as its contents the assignments for that day.
- Date of Cell – shows the date of the cell.
- Assignment of Employee – the contents of a day cell are known as an assignment – which is a person working at job on a unit on a specific day for a specific shift time period.
- Assignment Job – this is the job that the employee will hold during this particular assignment.
- Assignment Shift – this is the shift time period for the assignment.
- Assignment Unit – this is the job that the employee will hold during this particular assignment.
- Assignment Start Time – if the shift is not for a standard Day/Evening/Night time-frame, this holds the non-standard starting time.
- Assignment End Time – if the shift is not for a standard Day/Evening/Night time-frame, this holds the non-standard ending time.

Fig. 30

Intermediate & Text Files Used in Process

Ref.# 5001: One type of Orders file

# Type Facility Worker Window wk/dy/sh/jb/un/qu/\$\$/nego

```
### 1 S F R C - Fac1:MARIA.DOE 0 0 1 1 0 0 0 MARIA.DOE 2 6 202 Sun
Dec 19 00:00:00 PST 1999 Sun Dec 26 00:00:00 PST 1999 0 0 0 0 0 64.0
0.0 64.0
### 2 S F R C - Fac1:ERNESTINE.SMITH 0 0 1 2 0 0 0 ERNESTINE.SMITH 3
6 203 Sun Dec 19 00:00:00 PST 1999 Sun Dec 26 00:00:00 PST 1999 0 0 0 0
0 0 64.0 0.0 64.0
```

Ref.# 5002: One type of Deals file

# Stat Parties Exchange Fit Price & Terms When

```
### 1 Pending - 1 U 0 U 48 71 168.0 112.0 Fac0:K.DOLL-Fac1 1.0 0.0 - 0
1 0 0 0 Sun Dec 19 00:00:00 PST 1999 Sun Dec 26 00:00:00 PST 1999 0 0 0
1 K.JONES
### 2 Pending - 1 U 0 U 52 73 112.0 168.0 Fac1:KENDRA.SCOTT-Fac0 1.0
0.0 - 2 1 0 0 0 Sun Dec 19 00:00:00 PST 1999 Sun Dec 26 00:00:00 PST
1999 39 239 1 0 KENDRA.BREAU
```

